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ABSTRACT

In 1984, the University of Minnesota's College of Education and Wilson Learning Corporation created the Alliance for Learning to support a variety of research projects focused on developing new areas of knowledge about adult learning and new technologies for delivering training and education. This paper describes an Alliance project exploring the application of expert systems in the area of sales and sales management. The first part of the project involved the development of an expert system shell that would allow maximum flexibility and provide the capability to address a wide variety of individual performance issues. The second part involved developing a knowledge base derived from Wilson sales training materials and sales management subject matter experts. The outcome of the project was the development of an experimental expert system called "The Sales Coach." It is designed as a tool to allow sales managers to assess the individual needs of their sales staff and generate individualized development plans for improving performance. While the existing knowledge base represents generic Wilson sales training content, it is highly tailorable, allowing for complete customization. This document describes: (1) the research perspective that influenced the design of the shell and the knowledge base; (2) the method used to develop both; (3) the specific features of the resulting system; and (4) the significance of the system in the larger context of education and training in business and industry. Samples of computer screens from the expert system are included. (GL)

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THE APPLICATION OF ARTIFICIAL INTELLIGENCE TO HUMAN RESOURCE DEVELOPMENT

A Case Study in the Development of a Rule-Based Expert System for Performance Analysis and Development Planning

A Paper Presented at the Annual Meeting of the American Educational Research Association
San Francisco
March, 1989

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INTRODUCTION:

In 1984, the University of Minnesota's College of Education and Wilson Learning Corporation created a partnership to advance research on adult learning. This Alliance for Learning, as it came to be called, has supported a variety of research projects focused on developing new areas of knowledge about adult learning and new technologies for delivering training and education.

The Alliance project described here represents a combining of University and Wilson Learning Corporation resources to explore the application of expert system technology to the "ill-structured" tasks involved in coaching and development planning for performance improvement. It was decided that the project would focus specifically on the area of sales and sales management, a field in which Wilson has developed a strong base of expertise, and in which subject matter experts (SME's) and written materials would be readily available.

The project was divided into two distinct parts: Part 1 involved the development of an expert system "shell" that would allow maximum flexibility and provide the capability to address a wide variety of individual performance issues. Part 2 involved developing a knowledge base derived from Wilson sales training materials and sales management SME's. As information was collected for the various segments of the knowledge base, it was loaded into the expert system shell.

The outcome of the project was the development of an experimental expert system called "The Sales Coach." It is designed as a tool to allow sales managers to assess the individual needs of their sales staff and generate individualized development plans for improving performance. While the existing knowledge base represents generic Wilson sales training content, it is highly tailorable, allowing for complete customization.

In the pages that follow, we will describe the research perspective that influenced the design of the shell and the knowledge base, the method used to develop both, the specific features of the resulting system, and the significance of the system in the larger context of education and training in business and industry.

PERSPECTIVE:

The value of expert systems that "clone" the knowledge of a human expert has been demonstrated by a variety of applications in well-structured task domains ranging from medical diagnosis to controlling the amount of carbonation in soft drinks. Because the rules are less clear and the criteria of successful performance more ambiguous, there are fewer examples of successful applications of this technology to the complex, "ill-structured" tasks involved in expert performance in human interactions.

Although this type of domain poses some obvious difficulties in building a rule-based system, the project

team believed strongly that an expert system modeling high level performance on "people management" tasks could serve as both a powerful job aid and a training tool. While most sales organizations provide some formal training for the sales force, the maintenance and correction of day-to-day performance is usually left up to the individual manager. Like managers in other fields, sales managers are often uncomfortable and ineffective in carrying out the coaching role this expectation requires.

It was therefore decided that the prototype system would focus on providing assistance to managers in carrying out the tasks of identifying individual employee performance issues and development needs, and then creating a development plan for performance improvement. The system would serve both as a tool for creating performance improvement plans and as a model that would train managers more generally in the principles and techniques of effective coaching.

In the process of creating a system for sales managers, it was clear that a broader result of this project would be a generalized model that could be used in any kind of task calling for the basic tasks of "diagnosis" and "treatment."

METHODS:

Development of the Shell:

It was decided that a key objective of the project was to ensure maximum flexibility and the capability for tailoring action plans that would address a wide range of

individual problems. The first part of the project was therefore devoted to the design and programming of a rule-based expert system shell using Turbo Prolog.

The Knowledge Base:

The current knowledge base is generic, combining information derived from a variety of sources. One important resource was Wilson's research in the area of sales competencies. Another valuable source of information was the written materials from Wilson Learning's generic sales training programs, which were reviewed exhaustively. In addition, structured interviews were carried out with SME's, including experienced Wilson sales managers and account managers, as well as representatives from some Wilson client organizations.

These resources provided both the content and suggestions for establishing diagnostic categories and corresponding coaching action plans.

System Design:

The system consists of several key functional sections, including a Diagnostic section, a Planning section, and an Explanation section. The user/manager begins a session by answering a series of diagnostic questions about an individual salesperson, or by calling up an existing file to be edited. Each selected question and its answer allows the system to deduce the next question to be asked. In this way the manager can focus quickly on the target performance

areas and can avoid answering questions that are not applicable to the situation.

The manager's answers to the diagnostic questions determine the individually tailored action plan which will be produced in the Planning section. The manager can enter the action planning section and browse through the plan, which is a series of recommended coaching actions for addressing identified developmental needs. This coaching plan can be further tailored through the use of a simple delete function that allows the manager to eliminate suggestions that are not applicable to the specific situation. The final plan can be saved as part of the individual's file and also printed out.

The Explanation function is optional, allowing the user to explore the connections between the diagnostic questions and the action plan.

The questions in the Diagnostic section are organized around four performance categories derived from Wilson course materials and interviews with SME's. The four categories include:

- Basic Sales Skills (Prospecting, Call Planning, Handling Objections, . . .)
- Self-Management Skills (Call Reluctance, Time Management, . . .)
- Interpersonal Skills - Performance Problems (Abrasiveness, Inability to work as a Team Member, . . .)
- Versatility Skills (Adaptation to buyers' social styles)

Each category consists of diagnostic questions designed to collect information about the individual employee. As each question is answered, the system selects successive questions to be answered. As was suggested above, the system was designed so as to simplify the question-answering process and allow users to have some control over the number of questions they wish to answer. Diagnostic rules determine how the system draws conclusions about employee performance, based on information provided by the manager in answer to the selected questions.

For the Planning section, the knowledge base is organized as a series of very comprehensive and highly detailed action plans. As a result of answers to questions in the diagnostic section, a plan is selected and tailored by the system to meet the needs of the salesperson. This plan contains detailed procedures for coaching responses to highly specific performance issues identified in the diagnostic section. The plan is organized hierarchically so that the manager can walk through the plan by opening a series of windows that reveal more and more detail. The design encourages the manager to browse through the plan, using the delete function to remove inappropriate suggestions, thereby tailoring it to an even higher degree.

Plans have been designed to be very detailed, providing a complete coaching "map" for giving initial feedback, motivating and reinforcing behavior change, overcoming resistance, teaching the employee how to improve, and

following up to ensure lasting improvement. Decision rules for when to coach on the job and when to select formal training have also been included in the plans. Given this extensive, action oriented knowledge base, the expert system and the manager work together to build a concrete, individualized action plan to be used in coaching for performance improvement.

The Explanation function represents graphically the logic of the diagnostic and action planning sections of the program. Statements are displayed in a tree structure that illustrates the relationship between diagnostic questions and performance implications. The complete structure of the action plan is also shown. Again, this part of the program has been designed to allow the user to browse through the structure using the cursor or pressing the space bar for a "guided tour."

PROGRAM DESCRIPTION

The current version of the system was designed to run on any IBM compatible computer with 640K of memory and two floppy drives or a hard drive. The tree structure drawn in the Explanation function has been implemented using "text mode graphics." This, plus the fact that the system can run in color or monochrome mode, results in a program that can run on virtually any display adapter/display combination. As described above, the system allows the user to create files, save them, retrieve and edit them. Action plans can be tailored, saved, and printed out.

EDUCATIONAL/TRAINING SIGNIFICANCE

The objective of this project was to demonstrate the feasibility of creating an expert model for a complex task such as sales coaching. By delivering the expertise in a useable, practical form, the system also represents an example of how expert system technology can be used as an aid to developing human resources, in addition to the more familiar applications in technical areas.

Wilson sales training experts and some Wilson client representatives who have seen demonstrations of the system have indicated that it has potential both as a "consultant" for managers who lack strong coaching skills and as a training tool. The hypothesis is that ongoing use of the system calls attention to the type of information required to diagnose accurately and also illustrates the specific type of action required to address specific types of issues. Over time, managers who might lean heavily on the system at first will learn to become more independent of it as their experience increases.

The benefits to an organization include a greater assurance of consistency in the planning and delivery of coaching provided to employees, the quality of coaching becoming less dependent on the skills of the individual manager. If an easy to use and effective tool is in the hands of the manager, one could also assume that more of this kind of activity would take place.

The most important question in this regard involves the commitment of managers to use the system consistently. The answer depends in turn on how managers view their role in the development of their employees, how comfortable they are with coaching as an activity, how much priority is placed on it, and how comfortable they are working with a computer. While many sales organizations have become automated over the past few years, managers vary in terms of the equipment they have available and the degree to which they personally use a computer on a regular basis.

CONCLUSION

Although this version of the system was developed with a knowledge base that focuses on sales and sales management, there is great potential for transferring this technology to other applications. For example, a knowledge base could easily be written to link with general performance objectives for managers or individual contributors in other task domains. Action planning could also be adapted to corporate training programs or a customized development planning process. Any part of the knowledge base can, in fact, be tailored or customized to reflect the specific organization's language, philosophy and business strategy.

Only a few years ago, a project of this sort might have been seen as an academic exercise only, perhaps with implications for some future "real world" application. Now, with computers well established as essential daily tools used by managers and employees alike, there seems a

strong likelihood that applications like this expert system will be seen as offering a wide range of highly practical solutions to complex human resource problems.

the sales coach

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Press space bar to continue

Name	Planner	Why	Edit	Save	Quit

This computer program is a knowledge-based job aid designed to help sales managers create developmental, performance-improvement plans for their salespeople. The above menu box presents the Main Menu of the system with the options defined as follows:

Name	:accepts person's name and retrieves previously saved information
Planner	:assesses performance-improvement needs and suggests developmental interventions -- if complete assessment information has been retrieved by 'Name', implications and suggestions are presented
Why	:presents the 'line of reasoning' developed by the system in determining which suggestions are appropriate
Edit	:allows changes to answers which were made during assessment
Save	:stores the answers collected during assessment for later use
Quit	:terminates the program

The last line of the screen contains the message window which indicates the keys available and their action; it now contains 'Press space bar to continue'

Press space bar to continue

Name:TOM	Planner	Why	Edit	Save	Quit

Question

How well does the salesperson deal with customers who are detail oriented, and want well organized facts for decision making?

Answer

very_ineffective ineffective effective very_effective

Confidence

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Name:TOM	Planner	Why	Edit	Save	Quit

Implication

- The salesperson is ineffective with some customers who are drivers.
- The salesperson is ineffective with some customers who are amiable
- The salesperson is somewhat versatile in dealing with customers of different social styles, but still needs to learn the skills necessary to work with certain customers.
- This salesperson is assumed to have adequate sales skills to be an advanced beginner, but needs to develop more versatility in social relationships.

Press space bar to continue

Name:TOM	Planner	Why	Edit	Save	Quit

Suggestions

+Coach the salesperson to develop ability to recognize and adapt to different types of customers

More Detail

+Enhance salesperson's motivation by asking for his/her input and providing a summary of payoffs for versatility
+Enhance salesperson's ability to recognize categories of customer styles
+Give specific suggestions on improving effectiveness with amiable customers
+Give specific suggestions on improving effectiveness in working with driving customers
+Provide assistance to the salesperson in carrying out recommended strategies

Suggestion Window (Graph Symbol = Sug)

Give specific suggestions on improving effectiveness with amiable customers

of 2 conditions required

Action Step Window (Graph Symbol = Act) or Embedded Symptom (= Sym)

Recommend some strategies for improving effectiveness with customers who need to involve many people in the buying decision and are concerned about having everyone's support